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Multiple Micronutrients Versus Iron Folic Acid on Neonatal Breastfeeding Intervals and Period in Kenya

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Abstract: Exclusive breastfeeding within the first six months of life, provides sufficient infant nutrients, but remains a challenge for the postnatal women. Maternal pregnancy nutrient deficiency has long-term infant complications: heart disease; heart attacks; deaths; and irreversible cognitive challenges. Half of under five morbidity and mortality are associated with under nourishment. The study introduced multiple micronutrients to promote maternal nutrition to try and influence sustained exclusive breastfeeding to support neonatal and infant health. The study defined sub-populations at risk of nutritional deficiencies and provided opportunities for early intervention to support the known benefit of multiple micronutrients on breastfeeding outcomes up to six weeks (42 days) post delivery. The study determined variations on breastfeeding intervals and period among the Multiple Micronutrients (MMs) and Iron Folic Acid (IFA) groups. This was a Block Randomized Controlled study; treatment arm was administered with MMs while the control arm continued with the usual standard care of IFA. A structured Questionnaire with open and closed ended questions was employed to answer the research questions. Focus group discussions were conducted to collect qualitative data on impact of prenatal multiple micronutrients among the infants. The study demonstrated a significant difference in breast milk amounts and substitution between the treatment and control arm and assumed non-equal variances with a Levene's test <0.10 (f=7.379, p=0.009): breast feeding was initiated immediately at 100% for MMs and 68.8% for IFA; breast milk was available within 30 minutes post delivery in 86.3% of MMs and 25% for IFA (t, -4.8 p =0.000); breast milk amount was sufficient at 100% for MMs and 60.7% for IFA (-3.697, p=0.001); and no breast milk substitution was effected at 100% for the MMs, while breast milk was substituted in 18.5% of the IFAs within 42 days post delivery (t,-2.190, p=0.033). The study demonstrated significant benefits in micronutrient supplementation to promote infant health compared to the Iron folic acid use by enhancing exclusive breastfeeding practice.

Keywords: Substitution, Infant Health, Nutrient Supplementation

1. Introduction

Breastfeeding duration and exclusivity in Kenya, falls below the World Health Organization (WHO) recommended level, calling for interventions to benefit both infant and maternal health. [1] WHO recommends exclusive breastfeeding with exception to medicine and vitamin syrup, to infants till six months of age to achieve optimum growth. [2, 3] In Sub Saharan Africa, Ethiopia is the leading on exclusive breastfeeding with a prevalence of 70.5% with an awareness level of 92.4%. [4]

In Brazil, maternal education is associated with a high prevalence of exclusive breast feeding; however, locally antenatal education has not been proven to significantly increase exclusive breastfeeding. [5] This calls for randomized controlled studies with adequate power to evaluate effectiveness of breastfeeding interventions. [6] Face to face support in enhancing exclusive breastfeeding up to 6 months has been demonstrated to have better success rates. [7] Women have tried expressing their breast milk to

enhance exclusive breastfeeding but instead resulted in a shorter period. [8]

According to past studies, exclusive breastfeeding of the infant is related to a reduced risk of overweight gain or obesity later in the first year. [9] In Ghana, despite a 99% awareness on exclusive breastfeeding, only 10.3% of the women practice exclusive breastfeeding coupled with shorter maternity leave days. [10] According to past studies in Saudi Arabia, exclusive breastfeeding for the first six months is only practiced by 31.4% of the women. Working women are less likely to practice exclusive breastfeeding, remaining a challenge. [11]

The study undertook to establish the difference in breastfeeding intervals and period outcomes in use of multiple micronutrients versus the usual standard care of Iron folic acid supplementation among the pregnant women in the Nandi County. The multiple micronutrients was the treatment arm administered to the women in the intervention blocks and followed up to observe their impact on breastfeeding of the newborn children up to forty days post delivery.

2. Method

2.1. Ethical Review

Permission to conduct the study was sought through the Institutional and Ethical Review Committee (IREC), Moi University/Moi Teaching and Referral Hospital, Kenya. Approval was given vide FAN: IREC 1618. Thereafter approval of the study topic by the Board of Postgraduate Studies of Jomo Kenyatta University of Agriculture and Technology (JKUAT) was also granted after meeting all the University requirements. The study was then implemented officially after a written permission to implement the study within the Tea Estates was received from the Chief Executive Officer of the entire Eastern Produce Tea Estates, then the Doctor in charge of the Nandi Hills Doctors Scheme Association. Nandi County houses the Eastern Produce Tea Estates in Kenya.

2.2. Study Design

This was a sub-study of a block randomized controlled study. The Estates are organized into administrative blocks with an average area of about five kilometers wide with expansive tea estates. The estates are further divided into 4-5 villages of about 90-120 homes that houses the tea pluckers with their families. Each tea plucker is given a one roomed house used as a bedroom, living room and kitchen for the family and divided into rooms using large pieces of line hooked into the wall. The estates were adopted as blocks and randomized to either the treatment or control arms. All pregnant women within the treatment and control arm blocks, meeting the inclusion criteria, were enrolled within their villages and homes in the community, until the sample size was achieved. Twelve color coded cards were used to randomize the Estates into blocks i.e. 4 orange, 4 white and 4 green based on the Estates proximity and location. Each Estate was labeled as 'A' 'B' 'C' 'D'; 'E' 'F' 'G' H; and 'I' 'J' 'K''F' respectively. The twelve cards were placed in an opaque envelope and mixed thoroughly, then the Security guard In Charge at the Nandi Tea Doctors Scheme, was asked to pick a card at random blindly and place each card placed against each block (Estate) consecutively, till all the (three blocks) 12 cards were over from the envelop. The Estates with orange color were the intervention and green the control blocks correspondingly. Women pregnant within these Estates were enrolled into the control and intervention blocks respectively. The intervention blocks were administered with MMS and the control administered with the usual care and given IFAS correspondingly till the sample size was achieved.

2.3. Study Participants

Community entry was done by seeking permission from the estate manager, clinical officer and village headman. The village field educator escorted the researchers to the respective homes with pregnant women for study enrollment. Study participants from the treatment arm were administered with a fifteen micronutrients capsule daily with meals, while the control arm continued with the usual standard care of taking Iron folic acid. Pregnant women with a gestation of 16 weeks or more were eligible to be enrolled into the study. They were identified by the Field Educators using simple random sampling, between Monday and Friday. Thereafter, a visit was made to the villages, MMS for the intervention or IFAS for the control, was administered in their respective homes. Participants were enrolled from the fourth month of pregnancy and followed up till forty two days post delivery.

2.4. Study Implementation

A visit to the women's homes on enrollment was conducted by the Researchers and Field educators. A follow up visit was conducted to the homes within the first month; thereafter next visits were conducted, during the first month of the third trimester, a week within delivery and at forty two days post delivery. Data was collected during these visits; on pregnancy and neonatal health; breastfeeding duration and time for substitution of breast milk.

2.5. Statistical Analysis

The data analysis was initiated by calculating frequencies of the demographic data; women's parity, occupation, level of education, marital status, and neonates' gender at birth. Case summaries and reports were generated for the birth outcomes and breastfeeding. Thereafter, the same variables were subjected to inferential statistics by calculating the difference in means and the significance tests. Equal variances of the variables were not assumed in all the calculations; the Levene's tests had a significance level less than < 0.10. Data was presented in tables and graphs. Inferential statistics was applied by calculating the independent t-test to establish whether the difference in means being observed was by chance alone or manipulation

by the multiple micronutrients or Iron folic acid on the breastfeeding intervals and substitutions' variables.

Descriptive and inferential statistics was applied to quantitative variables. Descriptive statistics was undertaken on the demographic data i.e. age, occupation, marital status, education level and delivery data.

The study also had qualitative data which was mainly collected during the focus group discussions: the control and intervention clusters respectively. Hand written notes were carried out and applied in the data analysis. A voice recorder was also applied as a back up and to capture information missed out through the handwritten notes. The information in the voice recorder was transcribed and checked word per word to ensure no information was left out. Then the hand written notes from the two focus groups was compared with the transcribed information to ensure no detail was omitted. Thematic analysis was conducted to derive common themes in using multiple micronutrients versus iron folic acid between the groups. Qualitative variables derived from the questionnaires were expressed as percentages.

The outcome variables were the breast milk availability, amount and substitution and whether the baby was breast fed immediately after birth. A significance level of less that p = <0.05, was considered to be significant and concluded that the difference observed was due to the manipulation of the treatment arm i.e. multiple micronutrients in the study. All analyses were done using SPSS version 16.

3. Results

A total of sixty study participants met the inclusion criteria and were enrolled.

Most women had a parity of two at 38.8% (23) and zero parity at 32% (19). Most of the participants were tea pluckers at 58.3% (35) followed by 25% (15) who are housewives. The highest education level achieved by the women was tertiary at 3.3% (2) and secondary at 61% (37) *(See table 1 below.)*

Table 1. *Showing frequency distribution of mother's and baby's characteristics.*

Characteristic	Frequency	Percentage %
Parity- 0	19	32
1	9	15
2	14	23
3	4	6
4	4	6
5	5	9
6	5	9
Occupation – Business	2	3.3
Factory worker	4	5
Housewife	15	25
Tea plucker	35	58.3
Students	2	5
Teacher	2	3.3
Level of education - Primary	37	61
Secondary	21	35
Tertiary	2	3.3
Marital status – Married	50	83.3
Single	10	16.7
Newborn Gender - Male	34	56.7
- Female	26	43.3

Ref: Betsy original 1 2018

Among the newborns; 56.7% (34) were males and 43.3% were females. There was a difference in the mean birth weights between the groups: MMs group had a mean birth weight of 3.819 kilograms versus the IFA group with 3.237 kilograms. The mean birth weight difference between the groups was 0.582 kilograms (t, 2.41, p, 0.023). All the neonates were born alive at 100%, but at forty two days after birth, one child died in the IFA group *(See table 2 below).*

Seventy five percent of the children at forty two days had achieved a social smile and neck control in the MMs group compared to only 40% (12) with a social smile and 6.7% (2) with neck control in the IFA group (*See table 3*).

The infants at forty two days had increased their birth weight by an average of 1.49kgs for the MMs group compared to 1.55kgs in the IFA group.

Table 2. *Birth outcomes t-test statistics.*

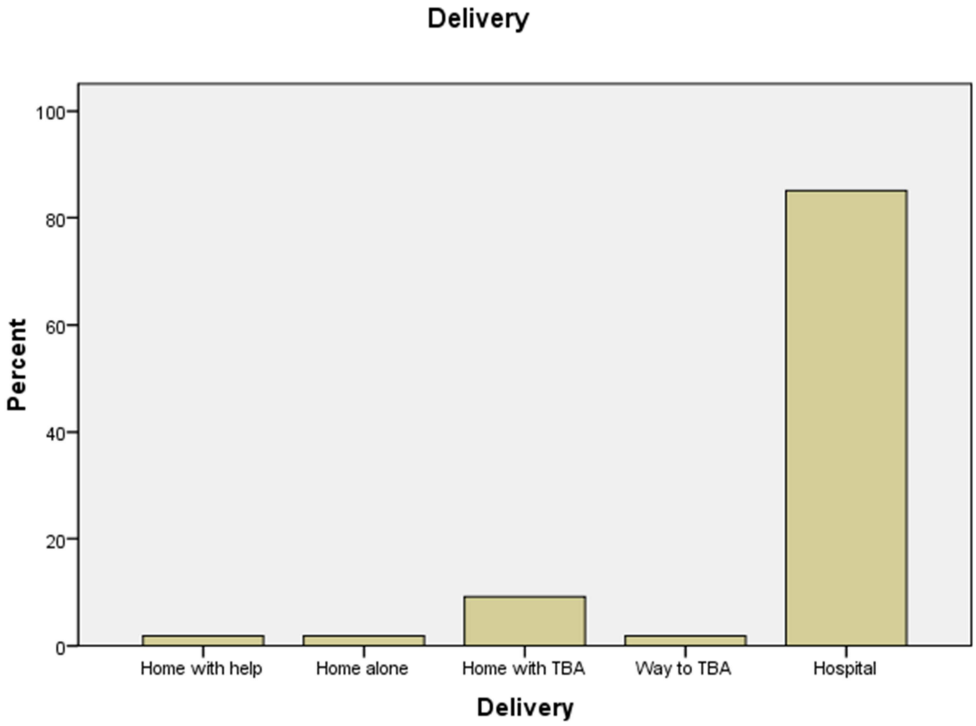
Variables	Levene's Test for Equality of Variances		t-test for Equality of Means				95% Confidence Interval of the Difference	
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Lower	Upper
Birth weight	8.7	0.005	2.41	58	0.023	0.582	0.088	1.077
Breast milk availability	6.1	0.018	-4.60	58	0.000	-1.855	-2.667	-1.043
Breastfeeding done	74.3	0.000	-2.72	58	0.009	-0.269	-4.684	-6.999
Breast milk Amount	3.5	0.000	-3.55	58	0.001	-0.385	-6.031	-1.66
Breast milk Substitution	32.9	0.000	-2.19	58	0.034	-0.192	-3.690	-1.53

Ref: Betsy original 2 2018

Breast milk was available within thirty minutes among 54.5% (16) of the MMs group compared to only 23.3% (7) in the IFA group. More than 60% (18) of the IFA group took over fifty minutes to breast milk availability.

Breast milk amount was sufficient for the neonates born to women in the MMs group compared to 60% (18) in the IFA group.

Breastfeeding was initiated immediately among 100% of the MMs group compared to 68% (21) of the IFA group. Breast milk substitution was not practiced among the MMs group compared to 18.5% of IFA group.



Ref: Betsy original 4 2018

Figure 1. *Showing Place of delivery n=60.*

Despite the referral system in place within the Tea Estates: eighty five percent of the total women had a skilled delivery but a total of about fifteen percent had unskilled delivery; either at home alone, with the traditional birth attendant (TBA) on her way to the TBA *(See figure 1 above).*

There was a significant difference in birth weight with a (t, 2.41 p=0.023). Therefore the noted difference in birth weight of 0.582 kilograms cannot be equated to chance alone but the multiple micronutrients introduced to the treatment arm.

Breast milk availability within thirty minutes had a significant difference between the groups with a (t, -4.60, p=0.000). Breast feeding therefore, was therefore initiated immediately giving a significant difference between the groups with a (t, -2.72, p=0.001). Breast milk sufficiency had a significant difference observed with a (t,-3.55, p=0.001). There was a significant difference in breast milk substitution between the groups with a (t, -219, p=0.034).

Table 3. *Frequency, means and standard deviation of neonatal outcomes.*

Variable	Measure	Supplements taken			
		MMs n=30	Percent	IFAs n= 30	Percent
1. Birth weight in kgs	Mean	3.819	Not applicable	3.237	Not applicable
	Median	3.300		3.200	
	Min	2.60		2.200	
	Std. Dev	+/- 1.01		+/- 0.545	
2. Birth outcome at birth	Alive	30	100%	30	100%
	Dead	0		0	
3. Birth outcome at 42 days	Alive	30	100%	29	96.7%
	Dead	0	0%	1	3.3%
4. Congenital malformation	None		None		
5. Baby milestones at 42 days	Social smile	22	75%	12	40%
	Neck control	22	75%	2	6.7%
	Grasping	7	24%	1	3.3%
	None of above	0	0	15	50%
6. Increase in birth weight in kgs	Mean	1.49		1.55	
	Median	1.55		1.50	
	Min	-1.00		-1.30	
	Maximum	3.10		5.20	
	Std. Dev	+/- 1.33		+/- 1.37	
7. Breast milk availability post delivery in minutes	Within 10	3	9.1	0	0.0
	11-20	7	22.8	1	3.3
	21-30	16	54.5	6	20.0

Variable	Measure	Supplements taken			
		MMs n=30	Percent	IFAs n= 30	Percent
	31-40	1	4.5	3	10.0
	41-50	0	0.0	2	6.7
	Over 50	3	9.1	18	60.0
8. Breast milk amount	Sufficient	30	100	18	60.7
	Not sufficient	0	0	12	39.3
9. Breast feeding done immediately	Yes	30	100	21	68.8
	No	0	0	9	31.2
10. Breast milk substitution	No	30	100	24	81.5
	Yes	0	0	6	18.5

Ref: Betsy original 4 2018

4. Discussion

The increase in birth weight observed in the study is equated to the use of multiple micronutrients use among the pregnant women in the study and is consistent with past studies. [12]

The difference observed in breast milk, availability and substitution in the study, is associated with the multiple micronutrient use among the pregnant women. Variations in breast milk nutrient content have been reported to be related to micronutrients dietary intake. Past studies have proven that zinc, copper and iron have been established to have no correlation between breast milk concentration and dietary intake. [11]

The exclusive breast milk prevalence established in the study was 81.5% within the first forty two days of infant live which was above the national overall observed; 61% in 2014. [13, 14] The exclusive prevalence observed in the study is higher than what was observed in a study in urban slums in Kenya which was 2%. [15]

The study also established that newborns more than a third; 36.7% were breastfed in the first thirty minutes following delivery and not consistent with the urban slum study that observed that 37% were not breastfed and 40% given breast milk substitution for the first three days. [15]

5. Conclusion

The study demonstrated that, the observed neonatal and infant outcomes cannot be equated to chance but the manipulation by the multiple micronutrients in the study supported by their significant outcomes. There was significant improvement noted on the neonatal and infant cognitive, neurological and physiological growth.

Use of multiple micronutrients contributed to the significant increase in newborn birth weight, infant birth weight increase, which is almost equivalent to the observed birth weight increase, in the Iron folic acid group substituting breast milk with other foods and water. The breast milk was sufficient for the infant; there was no breast milk substitution by the women in the group using multiple micronutrients up to forty two days. Use of multiple micronutrients enhanced immediate initiation of breastfeeding within thirty minutes of neonatal birth and breast milk availability enhanced exclusive breastfeeding within the first forty days of the infant life.

There has been a series of global, regional and national campaigns on exclusive breastfeeding to support the known benefits; sustainability has been improving slowly; use of multiple micronutrients will enhance uptake of exclusive breastfeeding practice for the infants, evidenced by sufficient breast milk experienced by the women up to forty two days post delivery.

There was no neonatal or infant mortality experienced: Multiple micronutrient use contributed towards reduction of neonatal and infant mortality. There is need for more support in promoting use of multiples micronutrients among the pregnant women to prevent maternal, neonatal and infant mortality, globally and especially in the LMICs where the study was carried out. More studies are needed to support and demonstrate the key role undertaken by the fifteen multiple micronutrients. There is need for a comprehensive WHO policy on multiple micronutrients intake during pregnancy, to replace the iron and folic acid.

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